

## **TOWARD X-RAY VISION: GEOPHYSICAL SIGNATURES OF COMPLEX SUBSURFACE PROCESSES**

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**Summary.** Developing a predictive understanding of water and contaminant fate and transport is complicated by natural heterogeneity, as well as by the disparity of scales across which hydrological, geochemical, and microbiological processes dominate. Because some geophysical attributes are sensitive to hydrological and biogeochemical properties that govern flow and transport, geophysical methods hold potential for minimally invasive and quantitative subsurface characterization.

This presentation will describe the relatively new fields of hydrogeophysics and biogeophysics, which strive to integrate geophysical and other datasets in the quantification of shallow subsurface variables. Several examples will be provided that illustrate how these methods can be used to gain significant insights about complex subsurface system processes, such as bacterial transport and remediation-induced biogeochemical transformations that occur as a function of subsurface heterogeneity. Examples will illustrate how geophysically-obtained estimates have been used to improve flow predictions and how geophysical signatures of surface area can potentially be used to inform reactive transport modeling. Beyond detailed geophysical quantification of subsurface properties, the presentation will also illustrate the utility of geophysical methods for providing diagnostic signatures of hydrogeological heterogeneity and critical system biogeochemical transformations over spatial scales that are relevant to many modeling and field experimental activities.